LOVELY PROFESSIONAL UNIVERSITY

Transforming Education Transforming India

Orientation to Computing-I

L T P :2 0 0

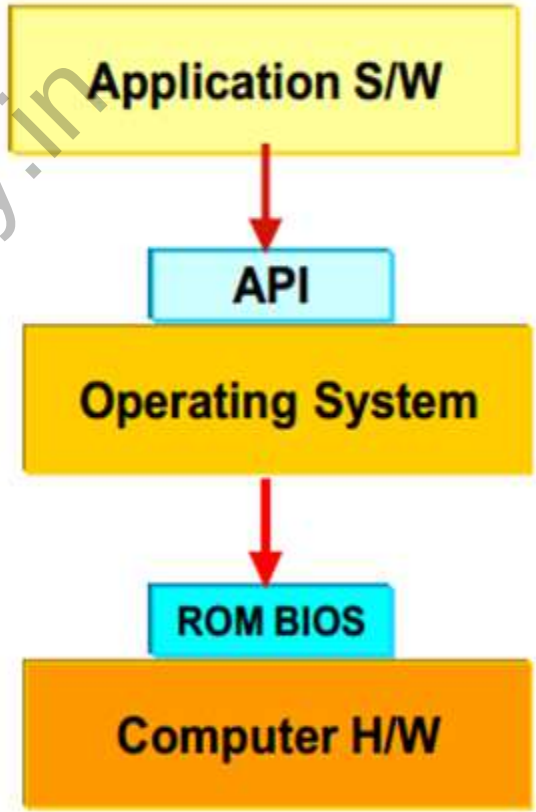
Unit-1 (Computer Systems)

- Basic structure of computer, working
- Computer associated peripherals
- Memories (Primary and Secondary)
- System Configuration
- BIOS configuration
- PC connection interface
- RAID, GPU basics , CPU and GPU

1-1 Digital Computers

- Digital – A limited number of discrete value
- Bit – A Binary Digit
- Program – A Sequence of instructions

- Computer = H/W + S/W
- Program(S/W)
  - A sequence of instruction
  - S/W = Program + Data
    - The data that are manipulated by the program constitute the data base
  - Application S/W
    - DB, word processor, Spread Sheet
  - System S/W
    - OS, Firmware, Compiler, Device Driver



1-1 Digital Computers

- Computer Hardware
  - CPU
  - Memory
    - Program Memory(ROM)
    - Data Memory(RAM)
  - I/O Device
    - Interface
    - Input Device: Keyboard, Mouse, Scanner
    - Output Device: Printer, Plotter, Display
    - Storage Device(I/O): FDD, HDD, MOD

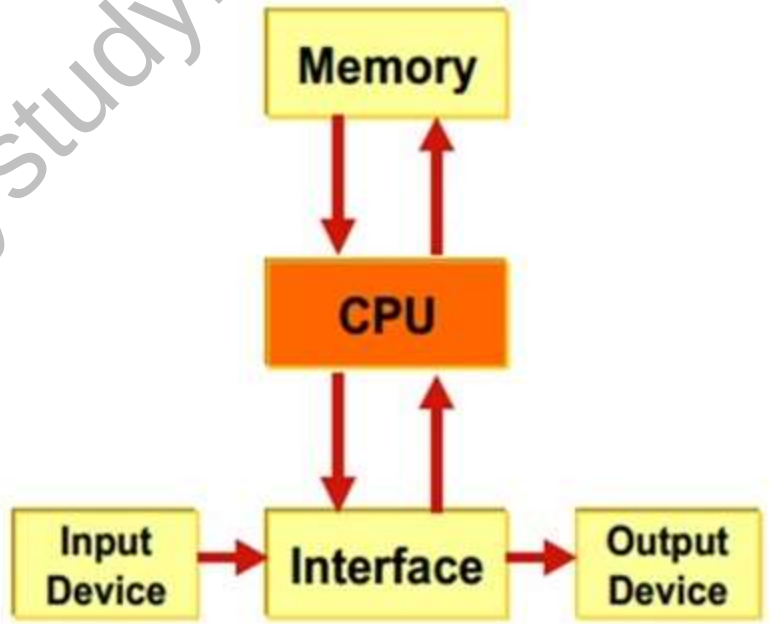


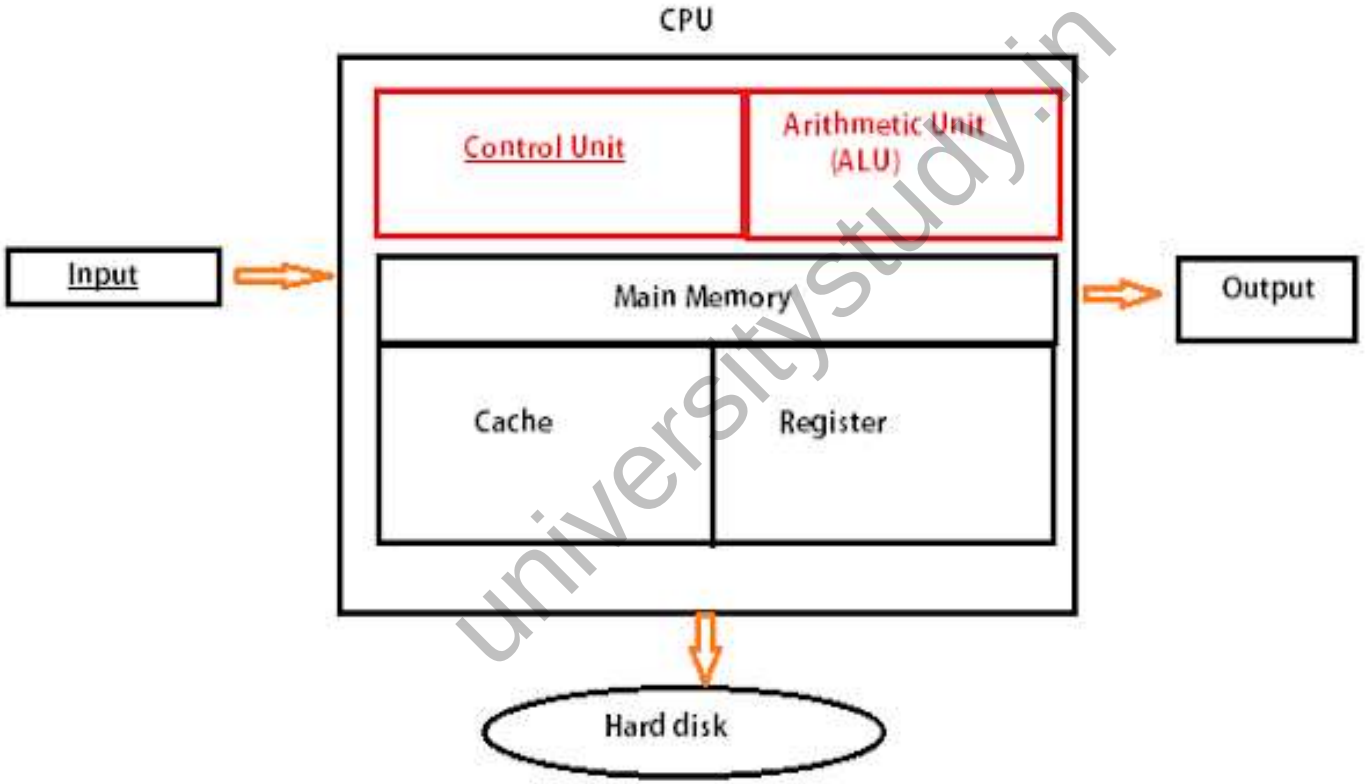
Figure *Block Diagram of a digital Computer*

1-1 Digital Computers

- 3 different point of view(Computer Hardware)
  - Computer Organization
    - H/W components operation/connection
  - Computer Design
    - H/W Design/Implementation
  - Computer Architecture
    - Structure and behavior of the computer as seen by the user
    - Information format, Instruction set, memory addressing, CPU, I/O, Memory
- ISA(Instruction Set Architecture)
  - the attributes of a system as seen by the programmer, i.e., the conceptual structure and functional behavior, as distinct from the organization of the data flows and controls, the logic design, and the physical implementation.

    - Amdahl, Blaaw, and Brooks(1964)

Structure of Computer



(Block diagram of working model of computer system)

Computer Associated Peripherals

- Computers are used to accomplish many tasks. A basic desktop computer desktop includes the computing unit plus a monitor, keyboard, and mouse.
- Add even more peripherals to the computer, and the computer will be able to do that many more tasks. But, what are computer peripherals?
- A **computer peripheral**, technically speaking, is any device that connects to the computing unit but is not part of the core architecture of the computing unit.
- The core computing unit consists of the central processing unit (CPU), motherboard, and power supply.
- The case that surrounds these elements are also considered part of the core computing unit.
- So anything that is connected to these elements is considered a peripheral.

List of Computer Peripherals

- Mouse
- Keyboard
- Monitor
- RAM
- DVD-ROM
- Microphone
- Webcam
- Printer

All of these are peripherals because they all are extra accessories that connect with the main computing unit to provide extra power and abilities. RAM, for example, gives the computer more room to process more operations more quickly.

Main Categories of Computer Peripherals: Uses & Examples

- The type of computer peripherals and their uses determines the category of the peripheral. The three categories are the following.

- Input devices
- Output devices
- Input/output and storage devices

- These categories are based on the direction of data flow. Some peripherals send data to the computer, while other peripherals receive data from the computer. Other peripherals can do both; they can both send and receive data from the computer

Input Devices

- **Input devices** are devices that send information to the computer.
- They do not receive information from the computer.
- Input devices are one-way devices.
- A mouse is an input device because it sends information to the computer.
- A mouse is used to tell the computer which way to move the cursor.
- A microphone is another peripheral that is an input device. The microphone sends audio data to the computer.

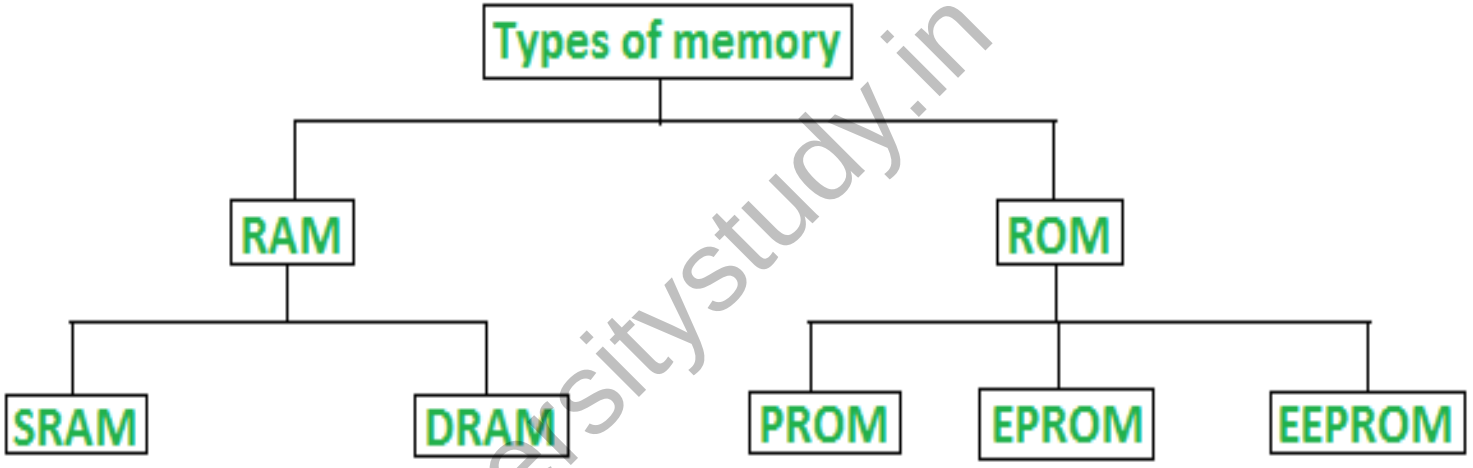
Output Devices

- An output device is a device that receives information from the core computing unit but does not send information to the computer.
- A speaker is an output device because the computer sends sound information to the speaker, but the speaker does not send sound information to the computer.
- Standard monitors are output devices as well since their job is to display graphical information from the computer.
- Standard monitors do not send information to the computer.
- Touchscreen monitors are not strict output devices

Memories

- Memory is the most essential element of a computing system because without it computer can't perform simple tasks.
- Computer memory is of two basic types – Primary memory(RAM and ROM) and Secondary memory (hard drive, CD, etc).
- Random Access Memory (RAM) is primary-volatile memory and Read-Only Memory (ROM) is primary-non-volatile memory.

Classification of Memory



Classification of computer memory

Random Access Memory (RAM)

- It is also called read-write memory or the main memory or the primary memory.
- The programs and data that the CPU requires during the execution of a program are stored in this memory.
- It is a volatile memory as the data is lost when the power is turned off.
- RAM is further classified into two types- SRAM (Static Random Access Memory) and DRAM (Dynamic Random Access Memory).

DRAM Vs SRAM

DRAM	SRAM
1. Constructed of tiny capacitors that leak electricity.	1.Constructed of circuits similar to D flip-flops.
2.Requires a recharge every few milliseconds to maintain its data.	2.Holds its contents as long as power is available.
3.Inexpensive.	3.Expensive.
4. Slower than SRAM.	4. Faster than DRAM.
5. Can store many bits per chip.	5. Can not store many bits per chip.
6. Uses less power.	6.Uses more power.
7.Generates less heat.	7.Generates more heat.
8. Used for main memory.	8. Used for cache.

Difference between SRAM and DRAM

Random Access Memory (RAM)

- **SRAM** is a type of volatile memory that stores each bit of data using a flip-flop circuit and can hold its state as long as power is supplied to the circuit. SRAM is faster and more reliable compared to DRAM because it doesn't require periodic refreshing to maintain data integrity.
- SRAM is commonly used for cache memory in CPUs and other applications where fast and reliable data access is crucial.

Random Access Memory (RAM)

- **DRAM** is another type of volatile memory that stores data using a capacitor to store a charge that represents each bit. Since capacitors naturally discharge over time, DRAM requires frequent refreshing to maintain the integrity of stored data. Each memory cell in DRAM is made up of a transistor and a capacitor.
- DRAM is commonly used as the main memory (RAM) in computers and other devices due to its lower cost per bit and higher density.

Random Access Memory (RAM)

- SRAM offers faster access times and doesn't require refreshing, but it's more expensive and consumes more power. DRAM is cheaper and offers higher memory density, making it suitable for main memory, but it requires periodic refreshing and has slightly slower access times compared to SRAM.

Read Only Memory (ROM)

- Read-Only Memory (ROM)
- Stores crucial information essential to operate the system, like the program essential to boot the computer.
- It is not volatile.
- Always retains its data.
- Used in embedded systems or where the programming needs no change.
- Used in calculators and peripheral devices.
- ROM is further classified into four types- MROM, PROM, EPROM, and EEPROM.

Read Only Memory (ROM)

- **Mask ROM (MROM)**: Mask ROM is manufactured with a fixed pattern of data during the chip's fabrication. The data is "masked" onto the ROM during production, and this data cannot be changed after manufacturing. Mask ROM is used for applications where the data needs to be permanently stored and cannot be altered.
- A masked ROM in a video game console might contain the essential instructions and data needed to boot up the console, load games, and handle user input.

Read Only Memory (ROM)

- **Programmable ROM (PROM)**: PROM is a type of ROM that allows the user to program data onto the chip after purchase. This is typically done using a special device called a PROM programmer. Once programmed, the data is fixed and cannot be changed again. PROMs are useful when data needs to be programmed at a later stage but still remain unalterable.
- Apple I computer, designed by Steve Wozniak used a PROM chip to store a program that was loaded and executed when the computer was powered on.
- PROM lacked the flexibility of being reprogrammable.

Read Only Memory (ROM)

- **Erasable Programmable ROM (EPROM)**: EPROM is similar to PROM, but it allows for data to be erased and reprogrammed using ultraviolet (UV) light. The chip is covered with a quartz window through which UV light can be used to erase the data. This process is relatively slow and requires removing the chip from the circuit.
- In Nintendo Entertainment System (NES), game developers would program their games onto EPROM chips, and these chips were then inserted into the plastic cartridges that players would insert into the console to play games. The EPROMs contained the game code and data necessary for the console to run the game.

Read Only Memory (ROM)

- **Electrically Erasable Programmable ROM (EEPROM)**: EEPROM, also known as E2PROM, is an evolution of EPROM that can be erased and reprogrammed electronically without removing the chip from the circuit. EEPROMs offer greater flexibility and ease of use compared to EPROMs.
- USB flash drives, also known as USB sticks or thumb drives, use EEPROM technology to store data. These drives are portable and can be connected to various devices via a USB port. The data stored in the EEPROM of a USB flash drive can be easily read, written, and rewritten by users.

RAM vs ROM

RAM	ROM
1. Temporary Storage.	1. Permanent storage.
2. Store data in MBs.	2. Store data in GBs.
3. Volatile.	3. Non-volatile.
4.Used in normal operations.	4. Used for startup process of computer.
5. Writing data is faster.	5. Writing data is slower.

Difference between RAM and ROM

Memory size

1 Byte (B)	8 bits
1 Kilobyte (KB)	1024 bytes
1 Megabyte (MB)	1024 KB
1 Gigabyte (GB)	1024 MB
1 Terabyte (TB)	1024 GB
1 Petabyte (PB)	1024 TB
1 Exabyte (EB)	1024 PB
1 Zettabyte (ZB)	1024 EB
1 Yottabyte (YB)	1024 ZB

Secondary Storage Devices

- A secondary storage device refers to any **non-volatile** storage device that is internal or external to the computer. It can be any storage device beyond the primary storage that enables permanent data storage.

- A secondary storage device is also known as an auxiliary storage device, backup storage device, tier 2 storage, or external storage.

Secondary Storage Devices

- Secondary storage devices primarily refer to storage devices that serve as an addition to the computer's primary storage, RAM and cache memory. Since they always consist of non-volatile memory, they allow the user to permanently store data on them.
- Typically, secondary storage allows for the storage of data ranging from a few megabytes to petabytes.
- These devices store virtually all programs and applications stored on a computer, including the operating system, device drivers, applications and general user data.
- They are used for a variety of purposes ranging from backup data used for future restores or disaster recovery, long-term archiving of data that is not frequently accessed, and storage of non-critical data in lower-performing, less expensive drives.

Use Cases of Secondary Storage Devices

- Today, many secondary storage drives are frequently external, especially since the introduction of USB flash drives and plug-and-play devices.

- Also, many secondary storage devices are now virtual devices residing on third-party cloud servers hosted by many services such as **Dropbox, Google Drive, Amazon Web Services (AWS),** or **Microsoft Azure.** Cloud repositories are particularly used by companies that embrace the software-as-a-service (SaaS) model.

Forms of Backup Storage

- Although many forms of backup storage such as tape drives and floppy diskettes have been long abandoned, secondary storage devices include:

- Solid-state drives (SSDs), Hard disk drives (HDDs), Cloud storage, CD-ROM drives, DVD drives, Blu-ray drives, USB flash drives, SD cards, Floppy diskette, Tape drives, Zip and Jaz drives.

- Secondary drives are assigned a letter from D: onwards by the modern operating systems.
- That's because historically, in old DOS and Windows operating systems, volume letters A:, B:, and C: were reserved for two floppy drives (A: and B:) and the primary drive (usually a hard disk).

Forms of Backup Storage

- A standard 3.5-inch **floppy disk**, which was commonly used in the past, typically had a capacity of 1.44 megabytes (MB).

Forms of Backup Storage

- **Magnetic tape** is a type of data storage medium that uses a long strip of plastic film coated with a magnetic material to store digital information.

magnetic-tape

Forms of Backup Storage

- Hard drives and solid-state drives (SSDs) have become more cost-effective, offer faster data access times, and are more convenient to use.
- Technologies like hard drives, SSDs, and optical discs have surpassed magnetic tape in terms of storage density, making them more suitable for handling large amounts of data in a smaller physical footprint.

System Configuration

- System configuration is a term in systems engineering that defines the computer hardware, the processes as well as the various devices that comprise the entire system and its boundaries.

- This term also refers to the settings or the hardware-software arrangement and how each device and software or process interact with each other based on a system settings file created automatically by the system or defined by the user.

System Configuration

- System configuration mainly refers to the specification of a given computer system, from its hardware components to the software and various processes that are run within that system.
- It refers to what types and models of devices are installed and what specific software is being used to run the various parts of the computer system.
- By extension, system configuration also refers to the specific operating system settings that have been set by default automatically or manually by a given program or the user.

Activity-1 for System Configuration

How do I find system configuration?

- To check your PC hardware specs, click on the Windows Start button, then click on Settings (the gear icon).

- In the Settings menu, click on System. Scroll down and click on About. On this screen, you should see specs for your processor, Memory (RAM), and other system info, including Windows version.

Hard Disk Drives (HDD)

- HDD stands for "Hard Disk Drive." It is a type of data storage device that uses magnetic storage to store and retrieve digital information.
- An HDD consists of one or more spinning disks (platters) coated with a magnetic material and read/write heads that move over the platters to access and manipulate data.
- The data is stored in sectors on the platters, and the spinning motion allows for rapid access to different parts of the disk.

Hard Disk Drives (HDD)

- In enterprise gear and massive 12TB external drives for home, for example, you can find stacks of hard drive platters in airtight disk enclosures filled with helium to keep the temperatures down and allow for higher performance.
- There are also advancements that aim to make hard drives even more efficient, such as energy-assisted magnetic recording, which is another enterprise-only feature for now.
- Despite these changes, the basic underlying hard drive technology remains the same: quickly rotating magnetic platters paired with read/write heads that travel over the platters' surfaces to retrieve or record data.

A Seagate Hard Disk Drive

The WD Black 4TB drive without its cover

Solid-state drives (SSD)

- SSDs use nonvolatile NAND flash memory to hold your files, with no mechanical parts or magnetic bits flying around, as we see in hard drives.
- By ditching the relative slothfulness of moving parts, solid-state drives deliver better performance.
- They're the fastest storage option available by far. Not only can SSDs read and write data much faster than hard drives with most workloads, but they can also access the data much more quickly.
- HDDs are susceptible to mechanical failures, generate heat, and consume more power compared to newer storage technologies like Solid-State Drives (SSDs). SSDs, which use flash memory instead of spinning disks, offer even faster access times, higher data transfer rates, and improved durability compared to both HDDs and magnetic tapes.

PCIe 4.0 NVMe SSDs, the Samsung 980 Pro

HDD Vs SSD

1. SSDs are much faster compared to Hard Disk Drives
2. SSDs are much costly compared to Hard Disk Drives
3. SSDs, if die, they die without any warning so you may lose your data if not already backed up
4. SSDs are good for people who need higher speeds as in gaming and real-time computing etc.
5. Hard Disk Drives are okay for people who require more of storage space compared to speed.

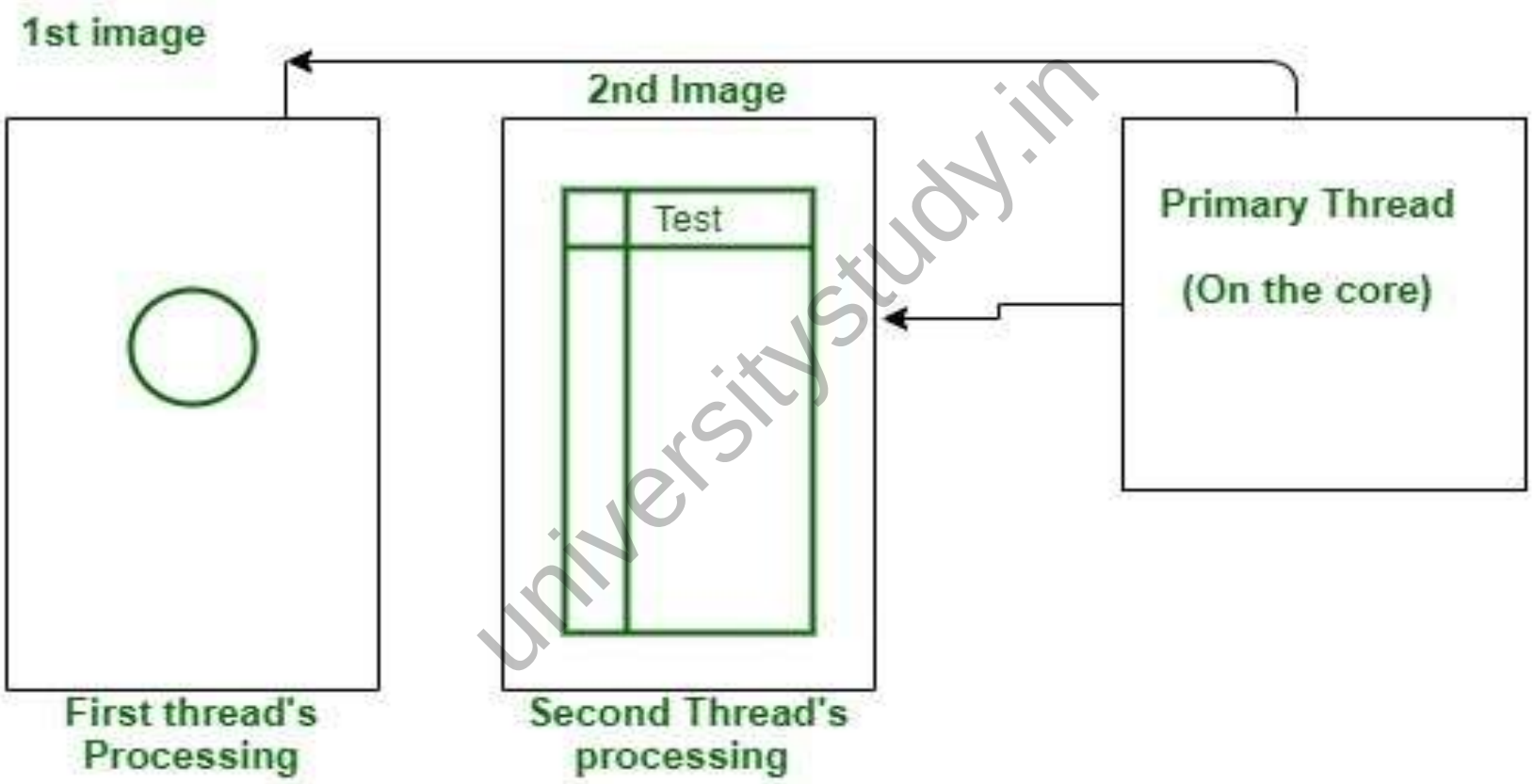
Processor

- A processor is an integrated electronic circuit that performs the calculations that run a computer. A processor performs arithmetical, logical, input/output (I/O) and other basic instructions that are passed from an operating system (OS).
- Most other processes are dependent on the operations of a processor.
- The terms processor, central processing unit (CPU) and microprocessor are commonly linked as synonyms. Most people use the word "processor" interchangeably with the term "CPU" nowadays, it is technically not correct since the CPU is just one of the processors inside a personal computer (PC).
- The Graphics Processing Unit (GPU) is another processor, and even some hard drives are technically capable of performing some processing.

Threads in Computer Processor

- Threads are the virtual components or codes, which divides the physical core of a CPU into virtual multiple cores.
- A single CPU core can have up-to 2 threads per core.
- A CPU with two physical cores, each supporting two hardware threads, is often referred to as a dual-core processor with four threads. These hardware threads can execute instructions in parallel or be scheduled independently by the operating system.
- For example, if a CPU is dual core (i.e., 2 cores) it will have 4 threads. And if a CPU is Octal core (i.e., 8 core) it will have 16 threads and vice-versa.

Activity -2 Example of Smartphone application



- The smartphone application is an example of this, when you open a app it shows a circle which spins continuously, this process is done by a thread created for this purpose only, and the second thread loads the information and presents it in the Graphical User Interface.
- The only fact that will limit the creation of the threads will be the number of the threads provided by the physical CPU, and it varies from CPU to CPU.
- The 1st image is the loading spinner by the first thread and the second one is the GUI loading by the second thread.

Use of Threads

- Threads have become a vital part of the computing as they allow the processor to perform multiple tasks at the same time making the tasks faster.
- And also making the computer capable of multitasking.
- Due to threads only you are able to browse the web as well as listen to music simultaneously.

BIOS Configuration

- A computer's basic input/output system (BIOS) is a program that's stored in nonvolatile memory such as read-only memory (ROM) or flash memory, making it firmware.
- The BIOS (sometimes called ROM BIOS) is always the first program that executes when a computer is powered up.
- BIOS identifies, configures, tests and connects computer hardware to the OS immediately after a computer is turned on.
- The combination of these steps is called the boot process.
- These tasks are each carried out by BIOS' four main functions.

BIOS Configuration

- **Power-On Self-Test (POST)**:
- When we power on or reset your computer, the BIOS begins by performing a series of diagnostic tests called the POST.
- The POST checks various hardware components such as the CPU, memory (RAM), graphics card, storage devices, and other peripherals to ensure they are functioning correctly.
- If any issues or errors are detected during the POST, the BIOS typically generates error codes or beep patterns to alert the user or technician to the problem.

BIOS Configuration

- **System Configuration and Setup (CMOS setup)**:
- The BIOS provides a user-accessible interface for configuring various system settings. This interface is typically accessed by pressing a specific key (e.g., Del, F2, or F12) during the early stages of the boot process.
- Users can configure settings such as the system date and time, boot order, CPU clock speed, memory settings, and hardware virtualization options within its CMOS.
- This means that every change we make to our BIOS structure is saved on this special memory chip called the Complementary Metal-Oxide Semiconductor, or CMOS. The CMOS setup is responsible for setting our password, time, and date.

BIOS Configuration

- **Bootstrapping and Boot Sequence Control**:
- Once the POST completes successfully, the BIOS is responsible for initiating the process of loading the operating system.
- The BIOS determines the boot order, which specifies where the computer should look for an operating system to load. It can be configured to boot from different devices, such as the hard drive, solid-state drive, CD/DVD drive, USB drive, or network.
- The BIOS loads the bootloader, which is a small program that further initializes hardware and ultimately loads the operating system kernel.

BIOS Configuration

- **Low-Level Hardware Control (BIOS Drivers)**:
- The BIOS interacts directly with hardware components, including storage devices, display adapters, keyboard, and other input/output devices.
- It initializes these components and provides a consistent interface to the operating system, ensuring that the hardware can be controlled and utilized effectively by higher-level software.
- BIOS functions as a bridge between the hardware and the operating system, enabling the OS to communicate with and manage the hardware resources. It locates the software and drivers that interface with the OS once running.

Activity-3 How to Enter BIOS Setup on Windows PCs?

- Each and every time you press your PC's power button, the BIOS is the first operation to load your operating system and all of the personal settings that make your computer your own.
- Whether you need to update your BIOS or sweep it clean of systematic bugs, knowing how to enter BIOS is essential for PC users. In order to access BIOS on a Windows PC, you must press your BIOS key set by your manufacturer which could be F10, F2, F12, F1, or DEL.
- If your PC goes through its power on self-test startup too quickly, you can also enter BIOS through Windows 10's advanced start menu recovery settings.
- One thing PC users love most about Windows is how many options you can configure directly within your selected system.
- Even before your computer has completed a full startup, you can venture into your BIOS software to modify the boot order, enable hardware components, or change the system time and date.

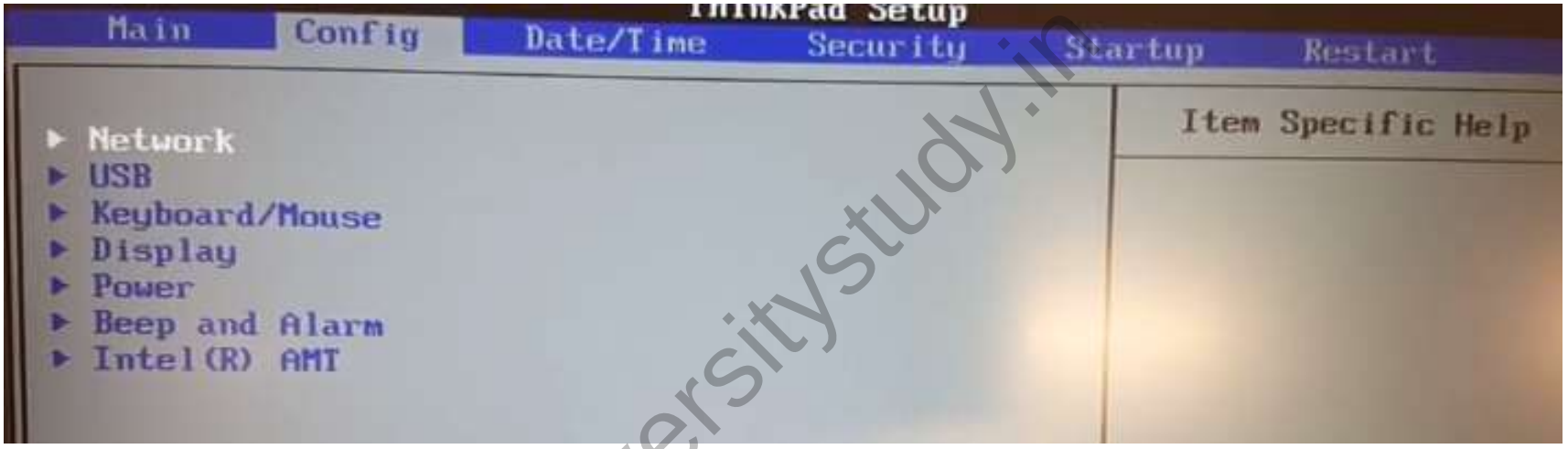
Methods to enter in BIOS in Windows

- Method #1: Use hotkey during boot-up
- Method #2: Use Windows 10's start menu

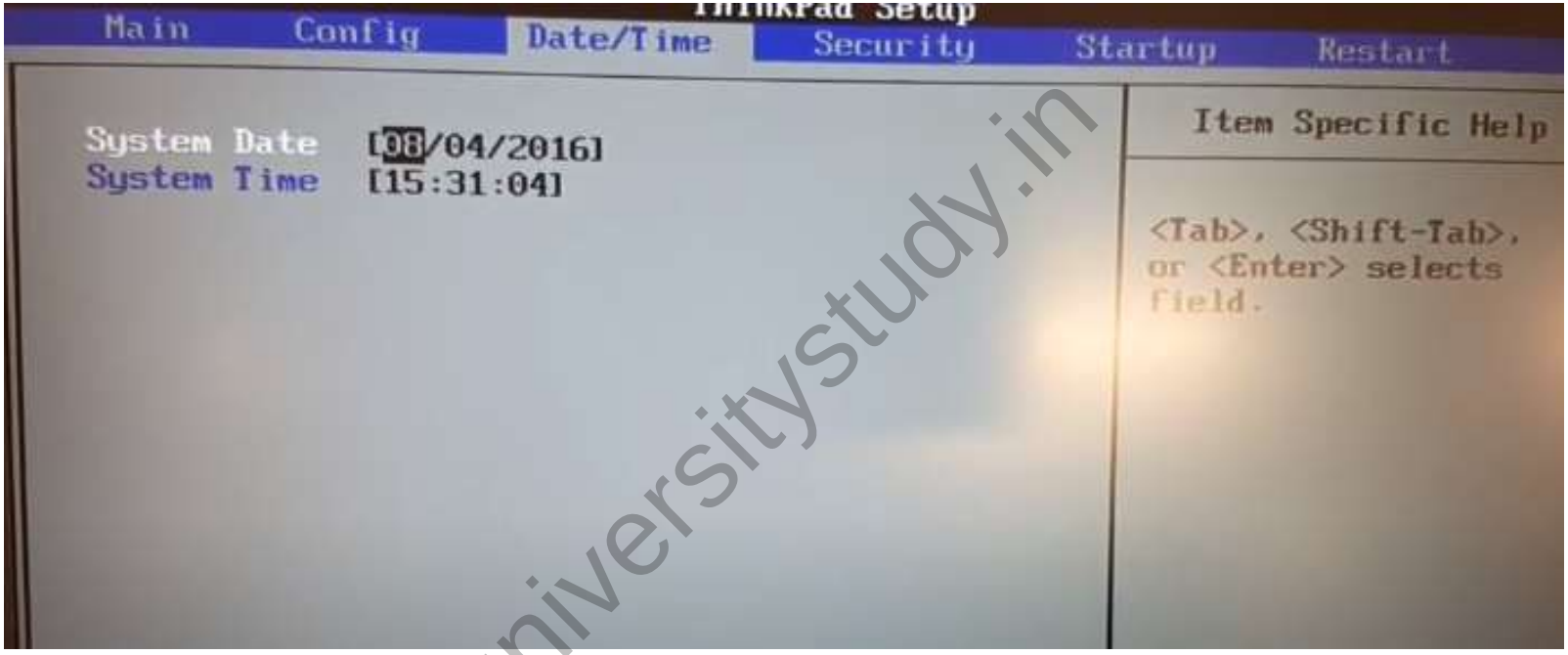
How to access Windows 7, Vista, and XP BIOS

- The same method of pressing your designated hotkey during boot-up should be able to gain you access into your BIOS. Be sure to press that button as soon as you see your manufacturer's brand logo.
- Older operating systems tend to load more slowly, so your window of time to press your designated hotkey should be wide enough for prompt BIOS access. Follow this three-step method to enter BIOS on Windows 7 or later.
- **Step 1.** Turn off your computer
- On older operating systems, you can only access BIOS just before the Microsoft Windows logo appears on your computer screen.
- **Step 2.** Power your PC on
- **Step 3.** Press the BIOS hotkey
- The single keystroke or combination of pressed keys will open BIOS on your PC. Oftentimes your computer will indicate on the startup screen which key or keys need to be pressed in order to enter BIOS.

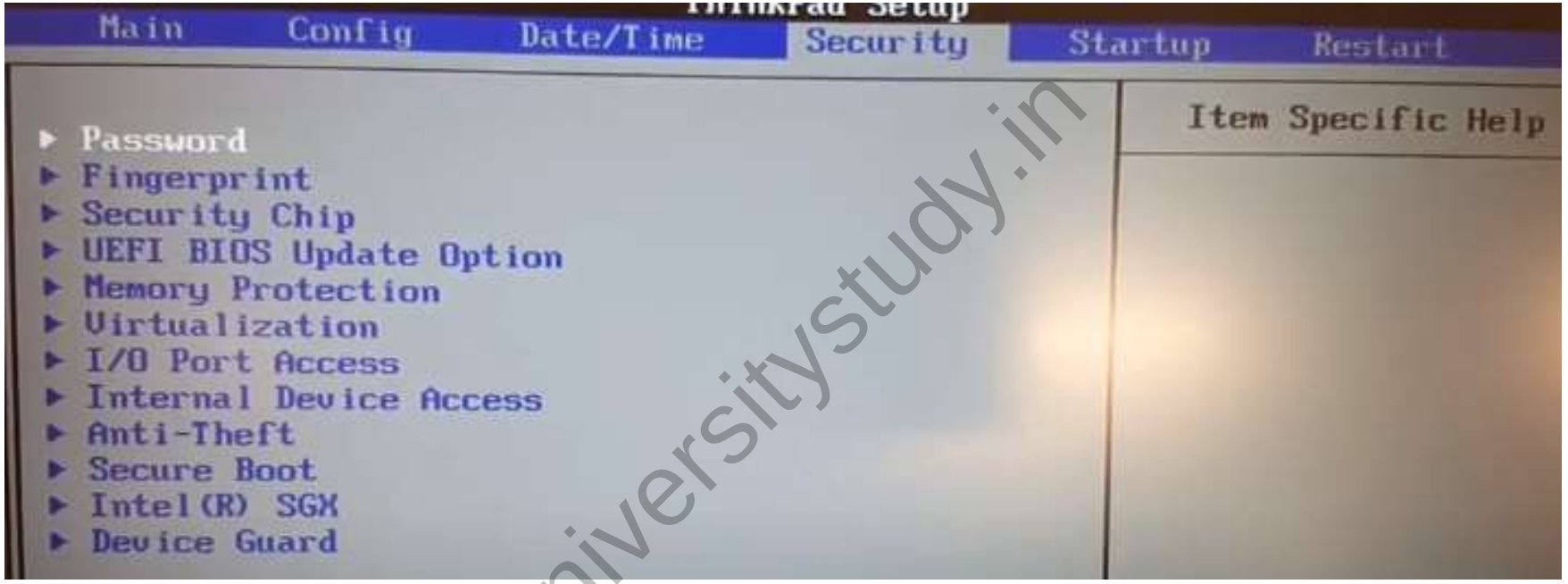
BIOS Settings



BIOS Settings

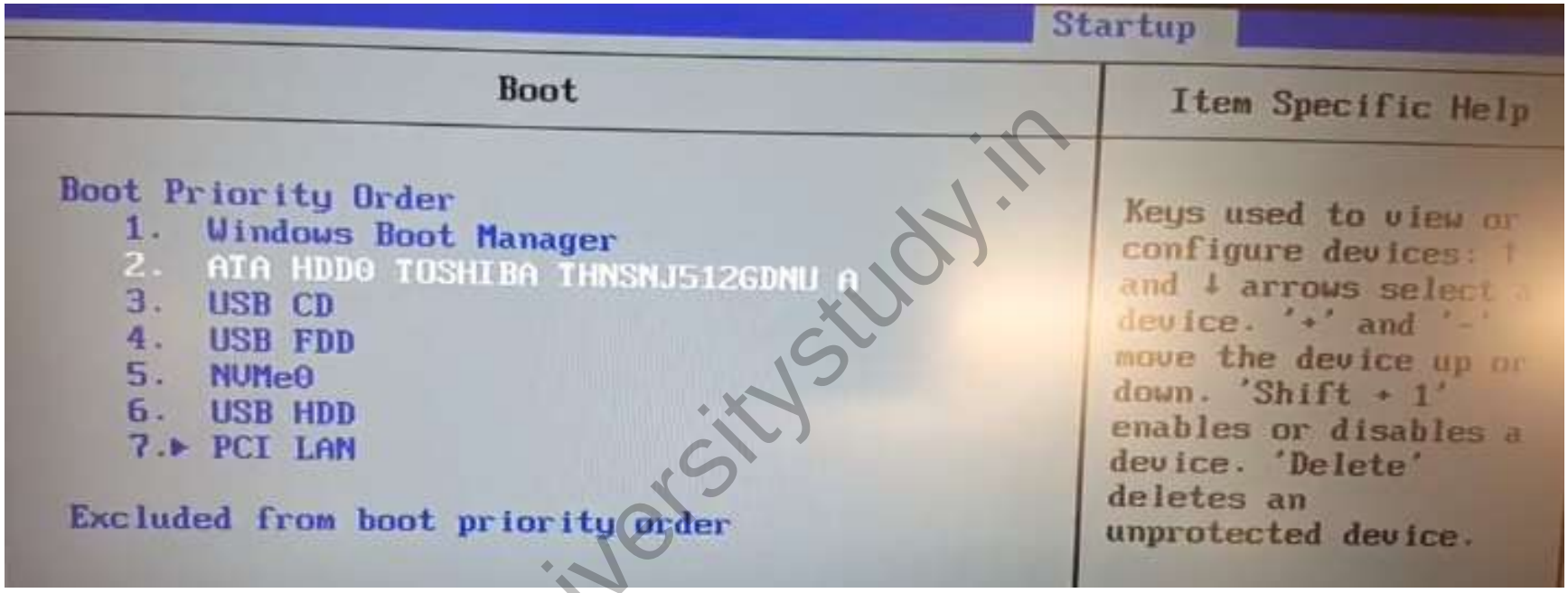


BIOS Settings

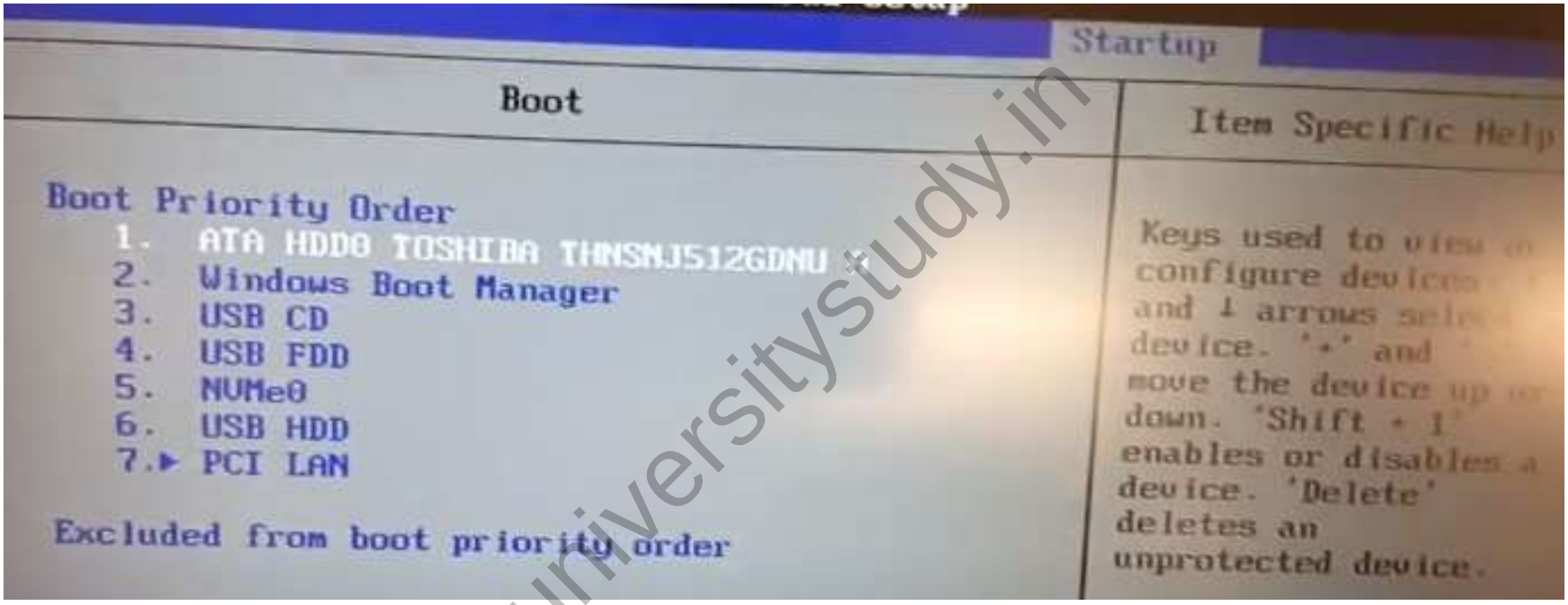


BIOS Settings

BIOS Settings



BIOS Settings



PC Connection Interface

- There are various PC connection interfaces . In this category USB has the largest share of the market due to its ease of use and device compatibility
- PCIe stands for PCI Express card bus and it is an internal bus.
- IEEE 1394,USB,eSATA are used for external hard disk connections
- Most commonly used Video connectors include VGA, HDMI, and DVI.
- For connecting an LCD monitor, you need a digital signal connector such as DVI or HDMI. PGA, and VGA are analog standards.
- The different versions of USB cables, like USB 2.0 and USB 3.0, are concerned with the functionality and speed of the USB cable; whereas, the type of USB cable (like USB Type A, USB Type B) essentially refers to the physical design of the plugs and ports.
- USB is used for connecting USB-compliant peripheral devices, and eSATA is used for connecting external eSATA devices such as eSATA disk drives.

There are a variety of USB connectors as illustrated in the figure below:

Most prominent among these are Type A, Type B, Mini Type A, Mini Type B, Type Micro A, and Type micro B.

Types of Connection Interface

- **VGA** : A Video Graphics Array (VGA) connector is a three-row 15-pin DE-15 connector. The 15-pin VGA connector was provided on many video cards, computer monitors, laptop computers, projectors, and high definition television sets. On laptop computers or other small devices, a mini-VGA port was sometimes used in place of the full-sized VGA connector.

- **HDMI (High-Definition Multimedia Interface)** is a proprietary audio/video interface for transmitting uncompressed video data and compressed or uncompressed digital audio data from an Compliant source device, such as a display controller, to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for analog video standards.

- **NFC:** NFC, short for Near Field Communication, is a short-range high frequency wireless communication technology that enables the exchange of data between devices over about a 10 cm distance.
- Due to its shorter range (less than 20cm), NFC provides a higher degree of security than Bluetooth (range of about 50m) and makes NFC suitable for crowded areas where correlating a signal with its transmitting physical device.
- **There are two different types of NFC:** Active and passive. Active NFC, which is currently used on many Android devices, as well as the new Apple devices, can send and receive data. Passive NFC, on the other hand, can only send data.
- However, passive NFC provides an extra benefit: The passive devices can run without power. For example, a student ID card may use NFC technology. If you tap the card on the bus, your card is passively transferring information through NFC to the bus system's active card reader.

- **SATA**, is full **serial advanced technology attachment**, also called **serial ATA**, an interface for transferring data between a computer's central circuit board and storage devices.
- SATA replaced the long-standing PATA (parallel ATA) interface.
- Serial communication transfers data one bit at a time, rather than in several parallel streams.
- Despite the apparent advantage of the parallel model, in practice serial transmission is less susceptible to interference, allowing SATA to operate at significantly higher speeds than PATA.
- The serial model also allows for simpler and slimmer cabling.

Activity-4 How to pair your Bluetooth device to a laptop

To pair a Bluetooth device

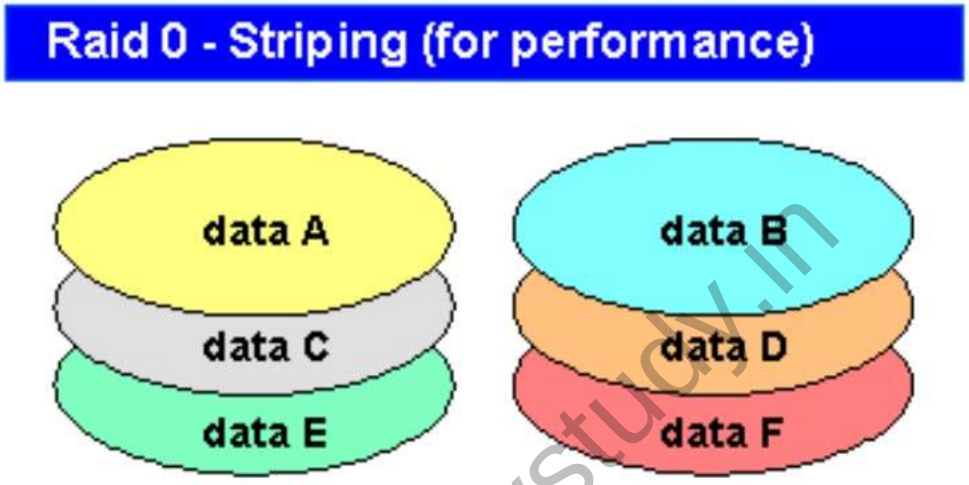
1. Turn on your Bluetooth device and make it discoverable. The way you make it discoverable depends on the device. Check the device or visit the manufacturer's website to learn how.
2. On your PC, select **Start** > **Settings** > **Bluetooth & devices** > **Add device** > **Bluetooth** .
3. Choose the Bluetooth device, follow additional instructions if they appear, then select **Done**.

- Your Bluetooth device and PC will usually automatically connect anytime the two devices are in range of each other with Bluetooth turned on.

RAID

- (**R**edundant **A**rray of **I**ndependent **D**isks) A disk or solid state drive (SSD) subsystem that increases performance or provides fault tolerance or both.
- RAID uses two or more physical drives and a RAID controller, which is plugged into motherboards that do not have RAID circuits.
- Today, most motherboards have built-in RAID but not necessarily every RAID configuration. In the past, RAID was also accomplished by software only but was much slower.
- In the late 1980s, the "I" in RAID stood for "inexpensive" but was later changed to "independent."
- In large storage area networks (SANs), floor-standing RAID units are common with terabytes of storage and huge amounts of cache memory.
- RAID is also used in desktop computers by gamers for speed and by business users for reliability. Following are the various RAID configurations.

RAID 0

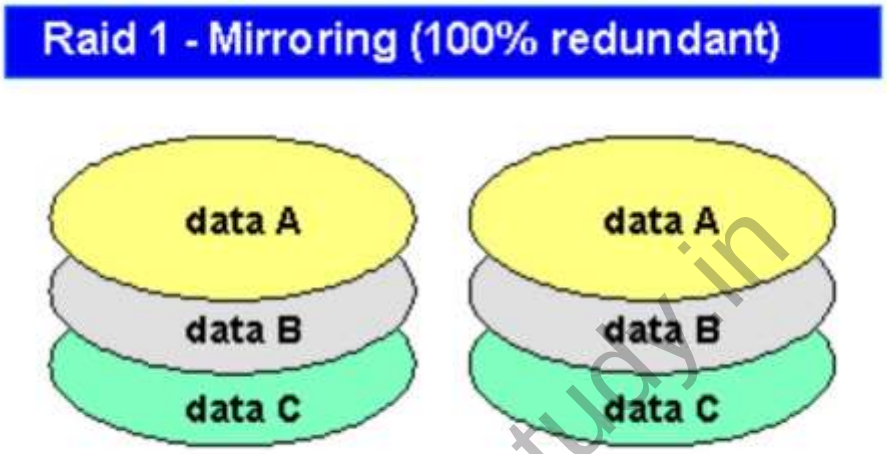


RAID 0 - Striping for Performance (Popular)

Widely used for gaming, striping interleaves data across multiple drives for performance. However, there are no safeguards against failure.

Data is divided into smaller chunks, and each chunk is written to a different drive. This parallelism allows for faster data access and transfer speeds. However, it's important to note that these RAID levels do not provide redundancy, so they prioritize speed over data protection.

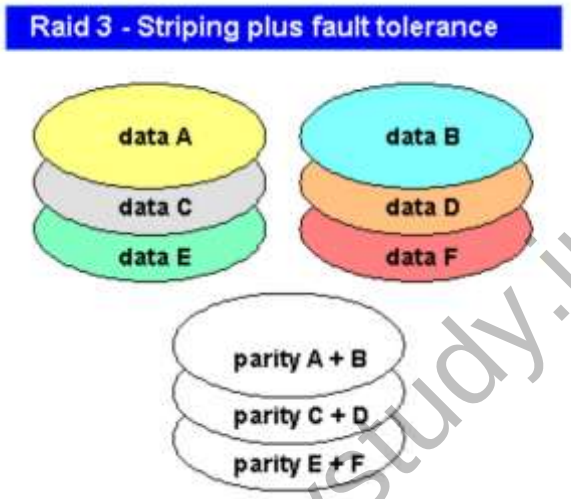
RAID 1



RAID 1 - Mirroring for Fault Tolerance (Popular) Widely used, RAID 1 writes two drives at the same time. It provides the highest reliability but doubles the number of drives needed. RAID 1+0 combines RAID 1 mirroring with RAID 0 striping for both safety and performance.

Data is duplicated on two or more drives, providing a direct copy of the data on each drive. If one drive fails, the data remains intact on the other drive(s).

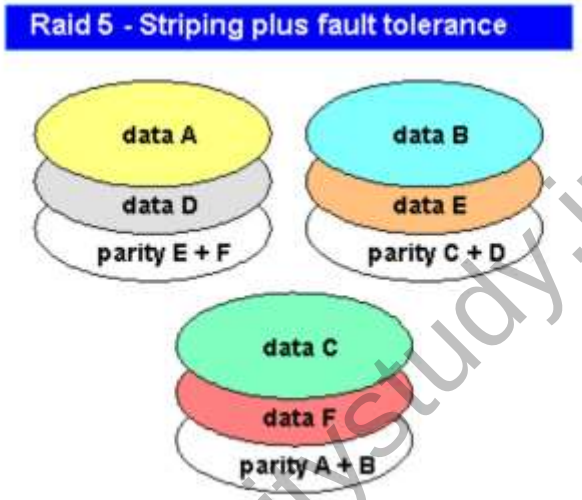
RAID 3



RAID 3 - Speed and Fault Tolerance

Data are striped across three or more drives for performance, and parity is computed for safety. Similar to RAID 3, RAID 4 uses block level striping but is not as popular.

RAID 5



RAID 5 - Speed and Fault Tolerance (Popular) Data are striped across three or more drives for performance, and parity is computed for safety. RAID 5 is similar to RAID 3, except that the parity is distributed to all drives. RAID 6 offers more reliability than RAID 5 by performing more parity computations.

GPU Basics

- Graphics processing technology has evolved to deliver unique benefits in the world of computing.
- The latest graphics processing units (GPUs) unlock new possibilities in gaming, content creation, machine learning, and more.
- GPU stands for graphics processing unit. GPUs are also commonly referred to as graphics cards or video cards. Every PC uses a GPU to render images, video and 2D or 3D animations for display. A GPU performs quick math calculations and frees up the CPU to do other things.

There are two different types of GPUs:

- Integrated GPUs are located on a PC's CPU and share memory with the CPU's processor.
- Discrete GPUs live on their own card and have their own video memory (VRAM), so that the PC doesn't have to use its RAM for graphics.

What Does a GPU Do?

- The graphics processing unit, or GPU, has become one of the most important types of computing technology, both for personal and business computing. Designed for parallel processing, the GPU is used in a wide range of applications, including graphics and video rendering.
- Although they're best known for their capabilities in gaming, GPUs are becoming more popular for use in creative production and artificial intelligence (AI).
- GPUs were originally designed to accelerate the rendering of 3D graphics. Over time, they became more flexible and programmable, enhancing their capabilities. This allowed graphics programmers to create more interesting visual effects and realistic scenes with advanced lighting and shadowing techniques.
- Other developers also began to tap the power of GPUs to dramatically accelerate additional workloads in high performance computing (HPC), deep learning, and more.